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8-2023

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# Multi-disciplinary Collaboration And The Use Of Technology in The Reduction Of Cardiac Surgical Site Infections

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## Children's Mercy Kansas City

### Background

Organizational surgical site infections (SSI) for cardiac surgery cases revealed an opportunity for improvement when compared against national benchmarks. Outcome measures are SSI rates and events. Additionally, the length of stay increases in patients with SSI with the potential for additional therapies, treatments, and procedures. Financial repercussions of a cardiac SSI have been documented with a median cost of \$136,950 per case (Sochet et al., 2017).

### Methods

Multi-disciplinary clinicians gathered for a rapid process improvement workshop (RPIW) and created a process map of the perioperative timeline, emphasizing variations in current practice and a gap analysis on evidence-based practice (EBP) guidelines.

Action plans, using improvement methodology were created in the following areas:

- Post-op Cardiac Incision Care
- Apparent Cause Analysis (ACA)
- Environmental Cleaning (ATP Testing)
- Sterile Technique-Back Table Drape
- Surgical Antisepsis-Standardized Preps
- Vancomycin Preop Timing
- Ultra-Violet Disinfection
- Closing Instrumentation
- Negative Pressure Wound Therapy

Figure 1 Chest Incision Care Algorithm

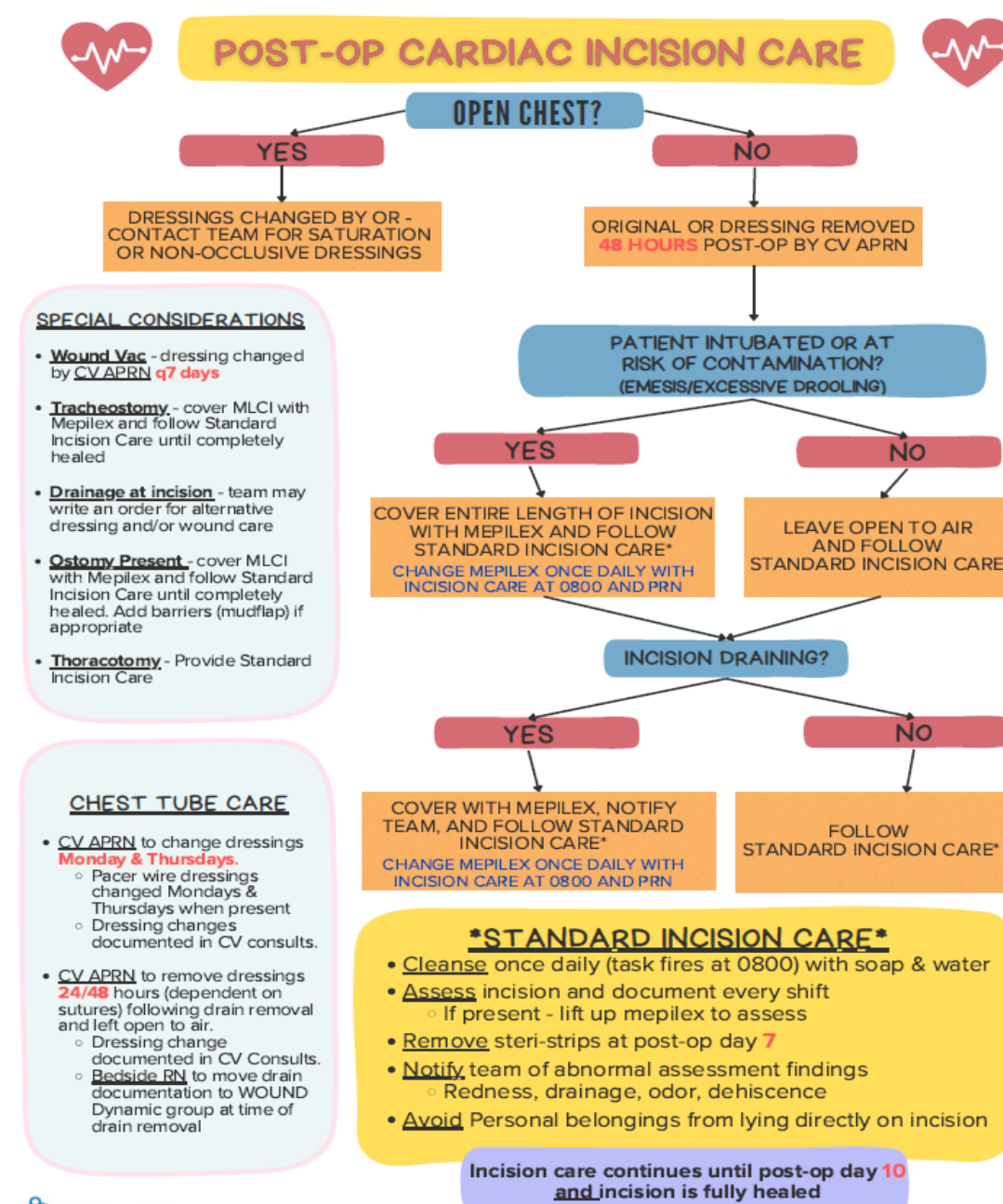


Figure 3 Environmental Cleaning (ATP Testing)

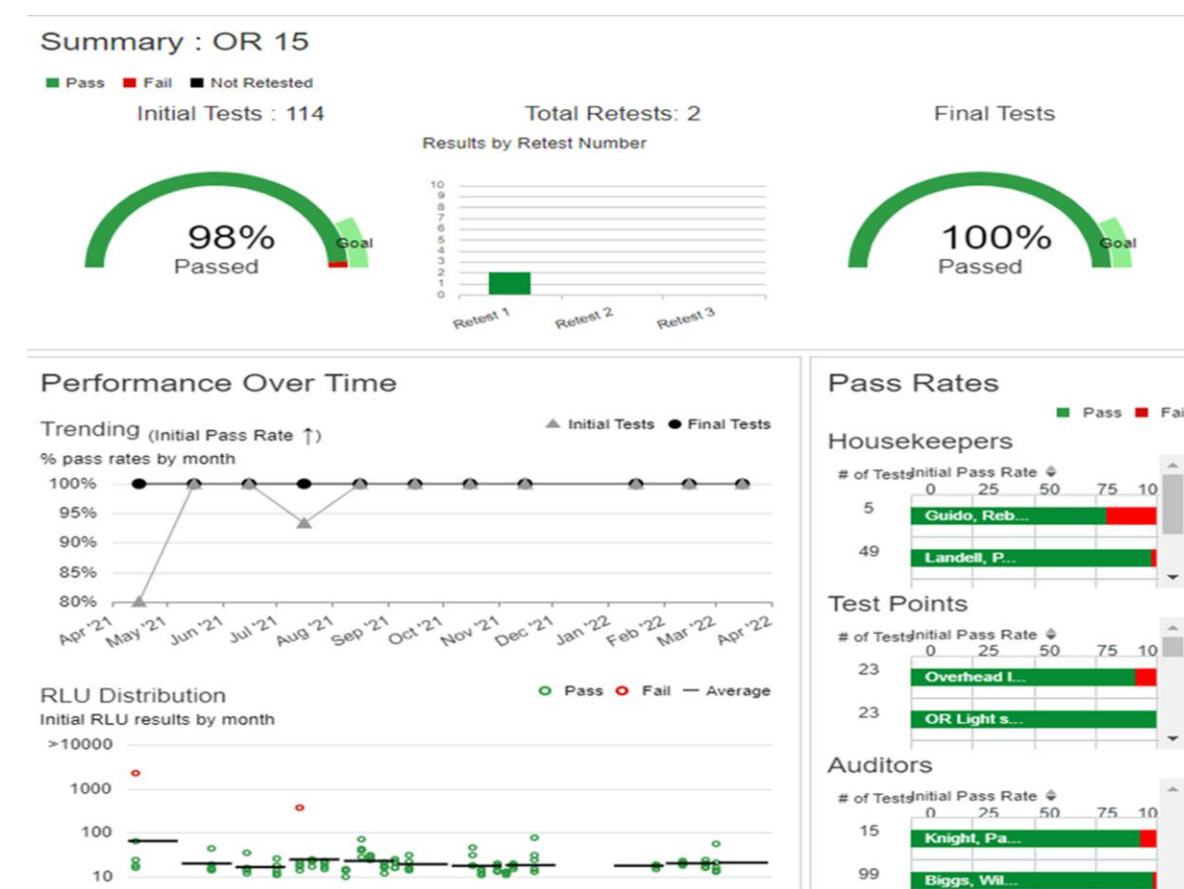


Figure 5 Vancomycin Preop Timing

Office of Evidence Based Practice (EBP) - Critically Appraised Topic (CAT): Surgical Site Infection: Timing of Vancomycin Infusion

**Specific Case Question:** In children undergoing cardiac, orthopedic, or neuro-shunt surgery, is there harm in completing vancomycin versus not completing vancomycin infusion prior to first incision? (harm includes surgical site infection (SSI), mortality, length of stay or costs).

**Recommendations Based on Current Literature (Best Evidence) Only:** A strong recommendation is made for starting vancomycin within 120 minutes of first surgical incision and completing the infusion prior to the first incision. The overall certainty in the evidence is low. (See Table 1. Harm of SSI, hospital length of stay, and cost were all lower in patients who met optimal timing of preoperative antibiotics. Harms that may be important to a pediatric population such as fever, pain, need for distraction, extravasation, traumatic intravenous catheter placement, or loss of intravenous access (Brewer Clinical Skills, 2020) were not measured as outcomes in any included study).

Three national guidelines/societies (Berrios Torres et al., 2017; Brazier et al., 2013; Rangel et al., 2015) agree that preoperative antibiotics should be infused to assure a bactericidal concentration of the medication is established prior to first incision. Most antibiotics can be infused over 15-30 minutes (Brazier et al., 2013). However, vancomycin requires a long infusion time to prevent an idiosyncratic hypersensitivity reaction called red man syndrome (Pohl, 1988). It is recommended that preoperative vancomycin infusion start within 120 minutes of incision to prevent the hypersensitivity reaction, and at least one cohort study showed patients who had vancomycin infusion that started 0 to 15 minutes prior to first incision had increased number of SSI compared to those who had infusion 15-120 minutes prior to first incision.

The overall certainty of the evidence is low. The included studies were all cohort studies, not randomized trials. The studies were not the same surgery type and the definition of optimal timing of vancomycin infusion varied among studies. See Table 3. However, a large effect size was found in the reduction of SSI when vancomycin was administered within the optimal time frame (see Table 1). Three national guidelines/societies concur on the importance of obtaining proper concentration of vancomycin and avoiding the known effect of too rapid infusion of vancomycin. If vancomycin were infused within the optimal time frame, there would be 54 fewer SSI per 1,000 patients undergoing cardiac or orthopedic surgery, with a range of 52 to 71 fewer infections (see Table 1).

**Literature Summary:** Background: The Centers for Disease Control and Prevention (CDC) guideline for Prevention of Surgical Site Infection, the American Pediatric Surgical Association Outcomes and Clinical Trials Committee, and American Society of Health System Pharmacists (ASHP) make cogent recommendations to administer preoperative antimicrobial medications timed such that bactericidal concentration of the agents is established when the incision is made (Berrios Torres et al., 2017; Brazier et al., 2013; Rangel et al., 2015). The CDC guideline is unable to refine the recommendation on timing of medication due to lack of randomized control trials that evaluated prophylaxis and the risk of SSI (Berrios-Torres et al., 2017). The inability to make a strong recommendation on timing is echoed by Rangel et al. (2015), who stated heterogeneity of studies on the timing of preoperative antibiotics decreases their certainty in making a strong recommendation regarding the question of preoperative antibiotic timing. However, Rangel et al. (2015) endorses the guidelines by the CDC and ASHP.

The Surgical Care Improvement Project (SCIP) developed quality initiatives to standardized infection prevention measures for adult surgeries and was introduced by the Centers for Medicare & Medicaid and the CDC in 2008 (Centers for Medicare & Medicaid and the Joint Commission, 2020; Rosenberger, Politano, & Sawyer, 2011). Germano to the question of this CAT, SCIP recommends that prophylactic antibiotics should be infused within one hour prior to surgical incision (Rosenberger et al., 2011). There is an exception for a subset of medications: vancomycin and fluoroquinolones. These subsets require longer infusion times ranging from 1 to 120 minutes prior to surgery by idiosyncratic hypersensitivity reactions (Golek, 2020; Weller, 2020). For vancomycin, a rare dependent hypersensitivity reaction is called "red man syndrome". It is characterized by histamine release and causes flushing primarily in the head and neck region. It is prevented by slowing the rate of vancomycin infusion (Khan & Soterby, 2010; Weller, 2020). The recommended rate of infusion of vancomycin is no faster than 10 mg/minute for a one-gram dose, or over a minimum of 100 minutes, whichever is slower to prevent red man syndrome. (Pohl, 1988).

Date Developed: August 12, 2020  
If you have questions regarding this CAT - please contact Kelly Fehlhafer, RN, BSN, MBA, CNOR on behalf of the Surgical Site Infection Improvement Team  
Lisa Schroeder, MD

Figure 2 Apparent Cause Analysis (ACA) Form

Patient Name	MRN
Date of Birth	Infection Date/Onset
Date of Surgery	Surgeon (from OR record)
	Surgery performed
	Event Number
Site	Name
Infection Control	Date
Present at bedside	
Preoperative Bundle	Bath: Yes / No, which product... No case use: Yes / No Antibiotic card: Appropriate? Yes / No Was prep antibiotic given upstart in ICU? (Timing administered appropriate) Yes / No Yes / No What else?
Was Mupirocin given?	Yes / No
Was there a preoperative infection?	Yes / No
OR Details	During the procedure and the following 48 hours, do you recall any details on the following questions: Did antibiotic product used... allowed to air dry? Yes / No Antibiotic reduced appropriately if surgery longer than 4 hours? Yes / No NA Was time out completed appropriately? Yes / No Was this an emergent surgery? Yes / No Was this a revision surgery? Yes / No Was this an elective surgery? Yes / No Was this related to a trauma? Yes / No Any abnormalities in the Sign-out? (e.g. sponge count) Yes / No Any change in wound class? Yes / No Estimated blood loss:
Timing	Delay into OR? Yes / No # of, what was cause? Time patient in OR room: Procedure start time: Procedure stop time:
Room Number	Exclusive staff? Yes / No
Number of staff at attention:	
Any outstanding circumstances:	
OR attire	
Instrument problems	
Immediate use products	
Break in protocol/procedure	
Communication	
Staffing	
Device procedures/injuries	
Any pictures in the chart?	
Additional Comments	
How often was dressing changed?	Order for dressing change: Was followed? Yes / No Products: Was there an application of ointment? Yes / No Product: Change instructions: What wound care was actually provided? Any known risk factors? (i.e. ports, hemostats, etc.)
Dressing details	
Home wound care	
Findings	How often were social characteristics shared in this event, if at all? (e.g. background, beliefs, culture, language, race/ethnicity, age, gender, sexual orientation, etc.) What has been the impact of the event on the patient? (LOS, needs, priorities, etc.) What are the current goals of care for this patient? What is currently being done to treat and/or prevent recurrence? What are the barriers to improve safety for this patient and other similar patients? (e.g. medication, action items, follow up questions)
Home Care	
Action Items	Who: What: When:

Figure 4 Sterile Technique-Back Table Drape

**RECOMMENDED PRACTICES**

**Implementing AORN Recommended Practices for Sterile Technique**

LYNNE KENNEDY, PhD, MBA, RN, CNRN, CNOR, CLRN

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**ABSTRACT:** Using sterile technique helps prevent the surgical environment from becoming contaminated and then can help reduce the incidence of surgical site infections. The AORN "Recommended practices for sterile technique" provides guidance for setting up, maintaining, and monitoring a sterile field. Topics include the use of surgical attire and personal protective equipment, appropriate selection and combination of surgical gowns, gloves, and drapes, and the use of sterile technique for maintaining and monitoring a sterile field, and techniques to ensure that items such as surgical instruments that may be contaminated are not used. Sterile technique should be covered immediately unless the actions necessary would endanger the patient. If remedial actions must be delayed, they should be undertaken as soon as possible. Adhering to best practices for sterile technique requires remaining up to date with new approaches and incorporating these into quality initiatives. *AORN J* 98 (July 2013) 15-23. © AORN, Inc. 2013. <http://dx.doi.org/10.1016/j.aorn.2013.05.009>

Key words: sterile technique, sterile field, aseptic, surgical site infection, transmissible, infection, contamination.

Very little is more central to perioperative nursing practice than implementing sterile technique. The recently updated AORN "Recommended practices for sterile technique" is evidence based and represents best practices for reducing the severity of surgical site infections. The surgical site infection (SSI) and preventing these from occurring are the primary goals of the sterile field. Involvement using specific techniques, actions, and activities to maintain sterility during care and other invasive procedures. Personnel, as members of a vigilance performance, as members of a vigilance performance that uses the principles in the recommended practice (RP) document, can help provide positive patient care.

**WHAT'S NEW?** This document was originally published in *AORN J* 98 (July 2013) 15-23. © AORN, Inc. 2013.

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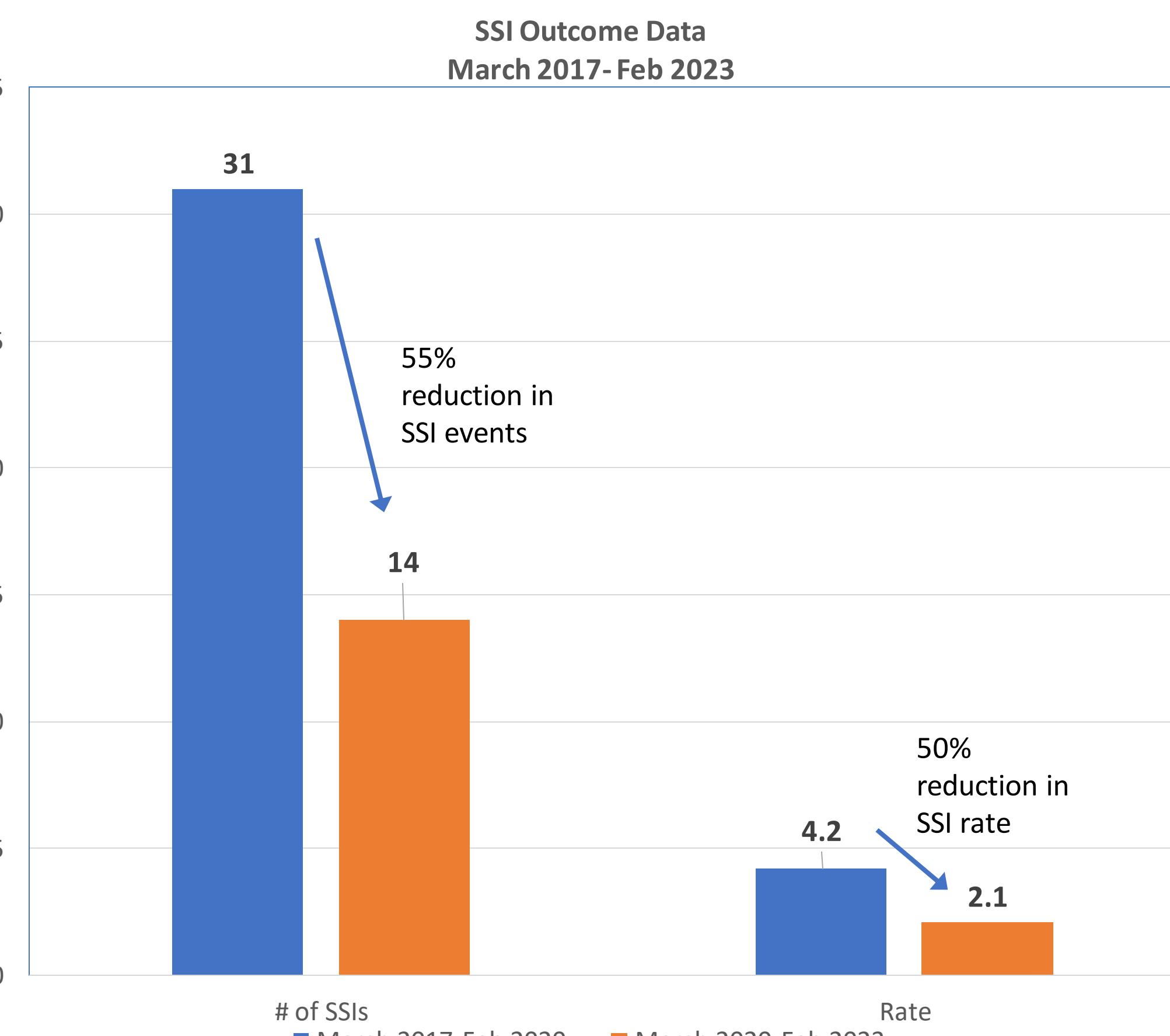
Figure 6 Ultra-Violet Disinfection



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### Results



### Conclusion

Multi-disciplinary and evidence-based approaches proved to be successful with the spread to other surgical specialties. Improvement methodology has been used to monitor and sustain positive results. Advances in technology and equipment has led enhanced use of Ultra-Violet disinfection technology and negative pressure wound therapy.

Sochet, A. A., Cartron, A. M., Nyhan, A., Spaeder, M. C., Song, X., Brown, A. T., & Klugman, D. (2017). Surgical Site Infection After Pediatric Cardiothoracic Surgery. *World Journal for Pediatric and Congenital Heart Surgery*, 8(1), 7-12. doi: 10.1177/2150135116674467

